

3D Science Classrooms: What Does the New Vision Look Like in the Science Classroom?



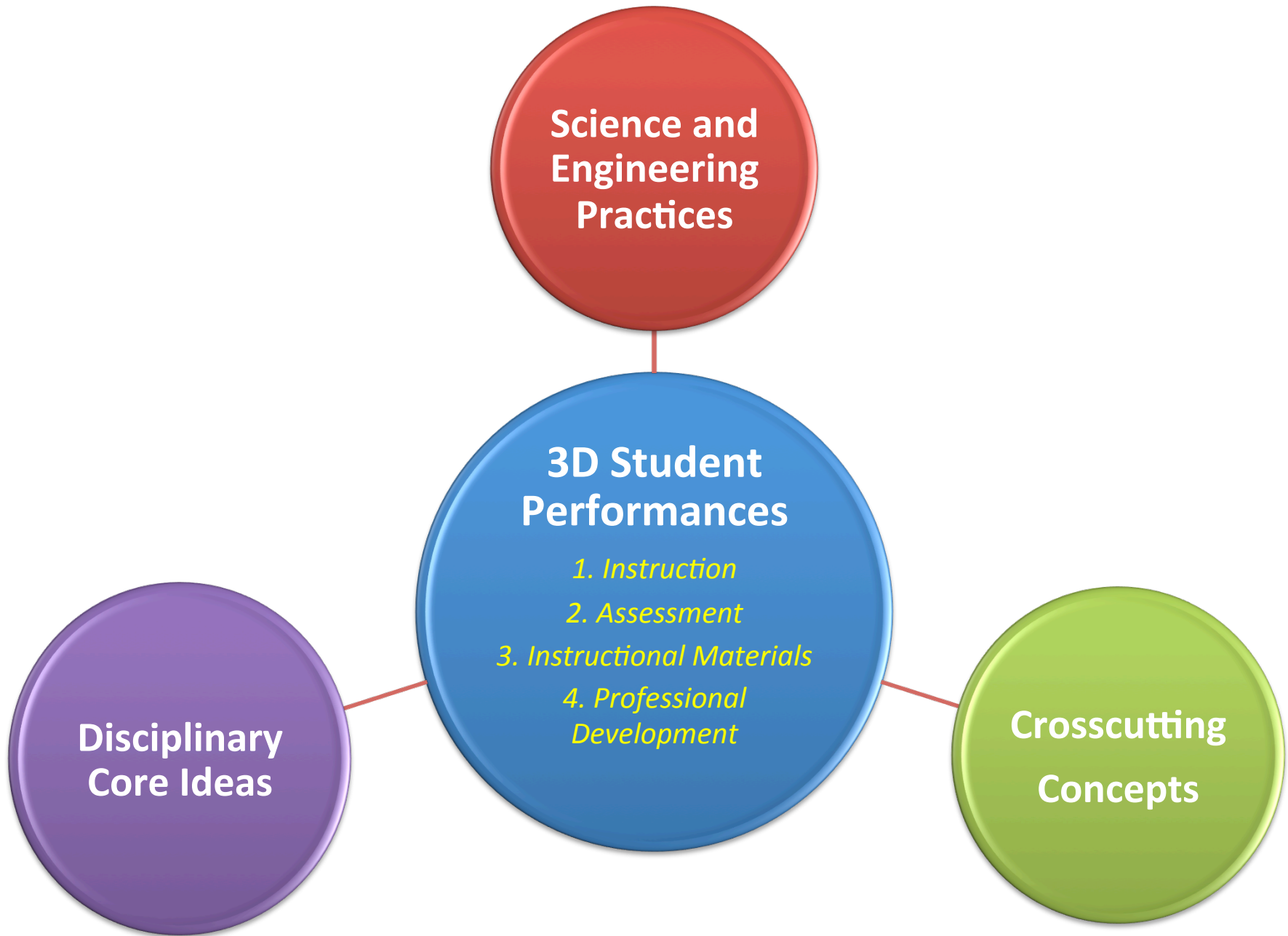
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What is a Student Science Performance?



- Students engage in science performances when they are “doing” science.
- Performances engage students at the intersection of the three dimensions of science
 - Science and Engineering Practices
 - Disciplinary Core Ideas
 - Crosscutting Concepts

3-D Model = Science Performance at the Intersection



Science and Engineering Practices

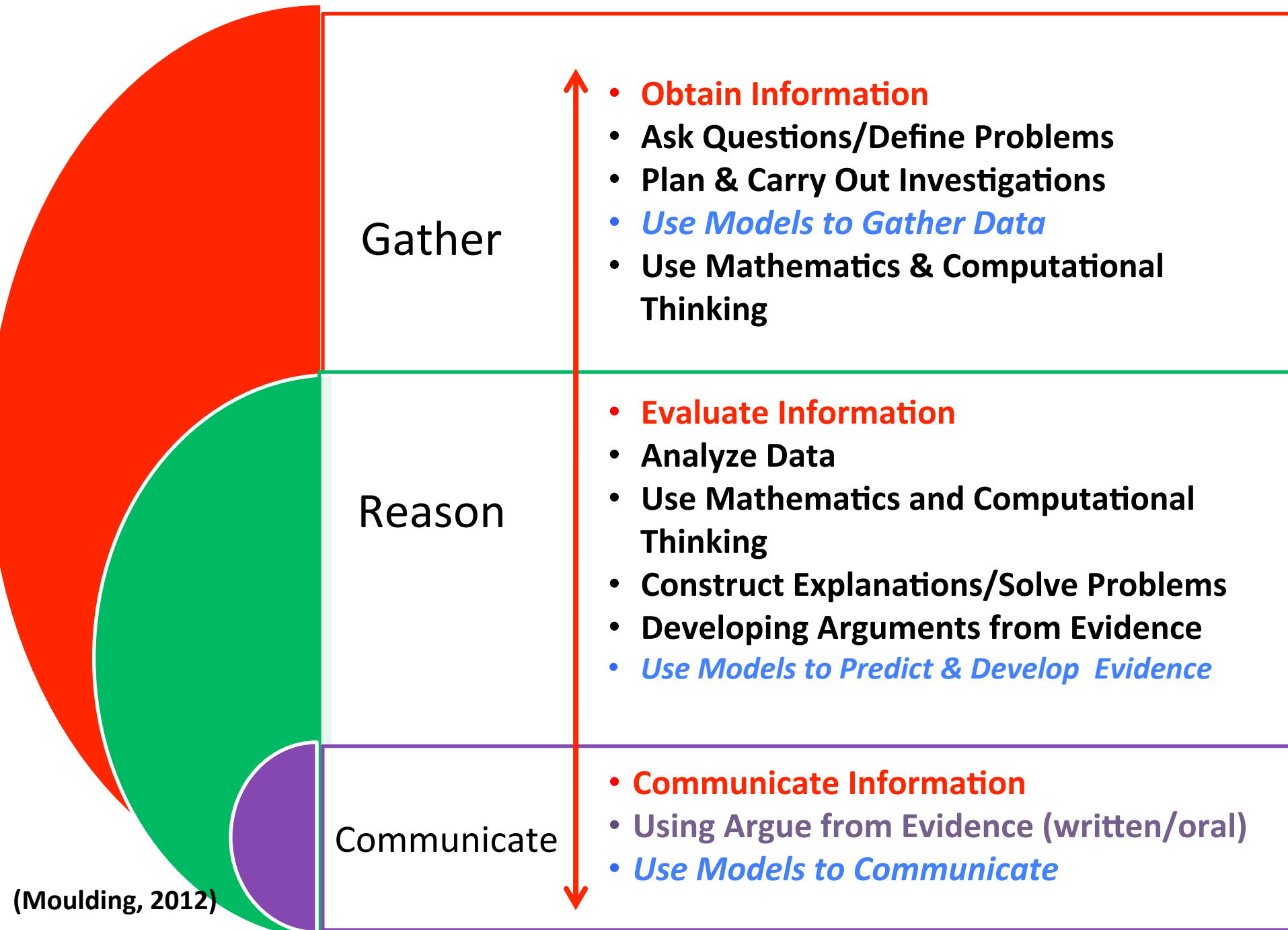


- Engaging in the practices of science helps students understand how scientific knowledge develops; such direct involvement gives them an appreciation of the wide range of approaches that are used to investigate, model, and explain the world. Engaging in the practices of engineering likewise helps students understand the work of engineers, as well as the links between engineering and science.
- Participation in these practices helps students form an understanding of the crosscutting concepts and disciplinary ideas of science and engineering; moreover, it makes students' knowledge more meaningful and embeds it more deeply into their worldview.

Science and Engineering Practices



1. Asking Questions (Science) and Defining Problems (Engineering)
2. Developing and Using Models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics, Information and Computer Technology, and Computational Thinking
6. Constructing Explanations (Science) and Designing Solutions
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information



(Moulding, 2012)

Crosscutting Concepts



- Although **crosscutting concepts are fundamental to an understanding of science and engineering**, students have often been expected to build such knowledge without any explicit instructional support. Hence the purpose of highlighting them as Dimension 2 of the *Framework* is to elevate their role in the development of standards, curricula, instruction, and assessments. Crosscutting concepts should become common and **familiar touchstones** across the disciplines and grade levels. **Explicit reference to the concepts**, as well as their emergence in multiple disciplinary contexts, can help students develop a cumulative, coherent, and usable understanding of science and engineering.

Framework, pg. 83

Crosscutting Concepts



- Crosscutting concepts help provide students with an organizational framework for connecting knowledge from the various disciplines into a coherent and scientifically based view of the world.
- Crosscutting concepts contribute to sense making of novel phenomena.
- The crosscutting concepts, when made explicit for students, contribute to their understanding of a coherent in a scientifically-based view of the world.
- The *Framework* describes seven crosscutting concepts that support understanding of the natural sciences and engineering.

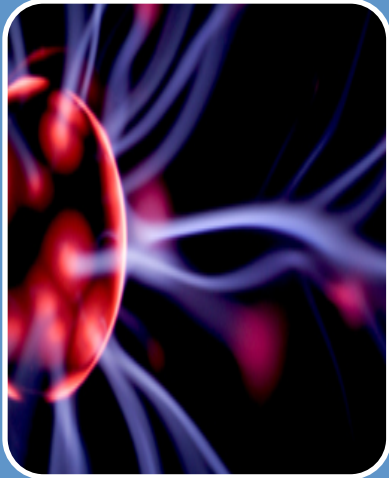
Framework, pgs 83 - 84

Crosscutting Concepts



1. Patterns
2. Cause and Effect
3. Scale, Proportion, and Quantity
4. Structure and Function
5. Systems and System Models
6. Matter and Energy
7. Stability and Change

Disciplinary Core Ideas



Physical Science

- PS1: Matter and Its Interactions
- PS2: Motion and Stability: Forces and Interactions
- PS3: Energy
- PS4: Waves and Their Applications in Technologies for Information Transfer



Life Science

- LS1: From Molecules to Organisms: Structure and Processes
- LS2: Ecosystems: Interactions, Energy, and Dynamics
- LS3: Heredity: Inheritance and Variation of Traits
- LS4: Biological Evolution: Unity and Diversity

Disciplinary Core Ideas



Earth and Space Science

- ESS1: Earth's Place in the Universe
- ESS2: Earth's Systems
- ESS3: Earth and Human Activity



Engineering, Technology, and Applications of Science

- ETS1: Engineering Design
- ETS2: Links Among Engineering, Technology, Science, and Society

Performance: Analyzing Data to Investigate Patterns and Support Explanations

Group Performance

1. **Investigate** the height a golf ball bounces off of a hard surface (concrete, tile) when dropped from various heights (*engineer ways to make accurate measurements*).
2. **Define the system** and **ask questions** about what **causes the observed patterns** in heights.
3. **Analyze data** and use representations to determine **patterns** and **mathematical relationships** for the data.
4. **Formulate questions** and **investigate explanations** for phenomena of the **pattern**.
5. Develop a **mathematical relationship** for the phenomena.

Individual Performance

6. Write in your journal or on note paper your **explanation** that may be used to explain this phenomena to others. Include **evidence** to support your **explanation** for why a pattern exists between the height of the drop and the bounce.

Discussion

Reflection

7. Reflect on the importance of **graphing data and using models** to make sense of phenomena.
8. Reflect on examples of other phenomena that have **patterns** and the **forces** that cause those patterns.

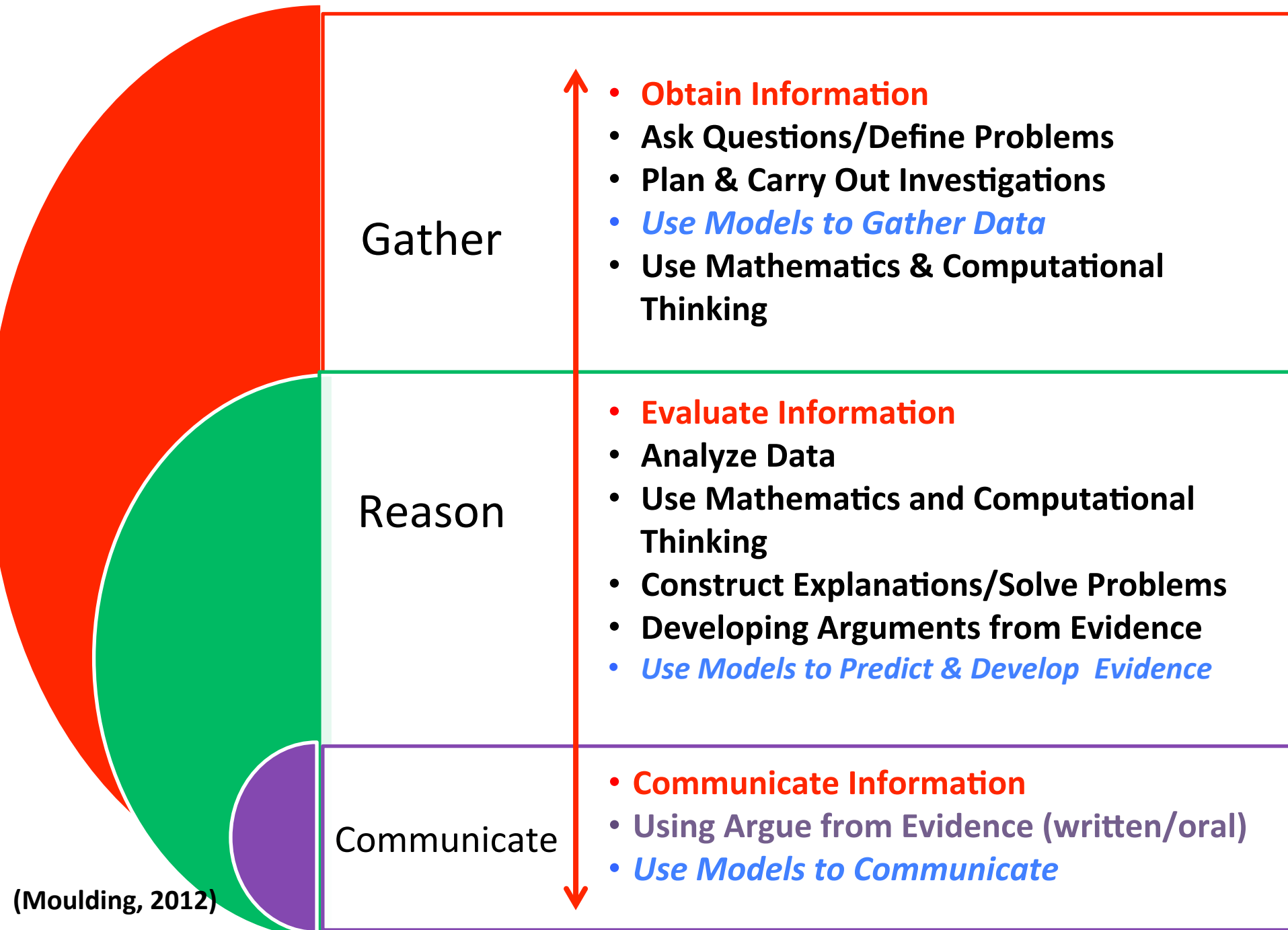
Teacher Reflection

- ✓ *Reflect on the nature of science instruction that supports students seeking **patterns** and using these **patterns** to make sense of “novel phenomena.”*
- ✓ *Reflect on the importance of **graphing data and using models** to make sense of phenomena.*

Science Performances



- Intersection of the Three Dimensions
 - Science and Engineering Practices
 - Disciplinary Core Ideas
 - Crosscutting Concepts



(Moulding, 2012)

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Discussion

